PROCESS FOR MOLDING BRICK AND BRICK PAVER

TECHNICAL FIELD

[0001] The present application is a continuation in part of applicant's previously filed, co-pending application serial number 09/982,170. The present invention relates to a process for molding solid building elements such as architectural face brick and brick pavers, and more particularly to a process which makes such solid building elements utilizing mass flow continuous mixing of a wet cement mix and with molding compression along one axis, in both positive and negative directions thereof.

BACKGROUND OF THE INVENTION

[0002] A traditional concrete block process for producing cement-based brick uses a machine that may be fitted with a set of brick or brick paver molds. These machines are fed from a batch mix of individually weighed components. Both mixer and machine must be shut down and cleaned when a color change or product change is made.

[0003] Alternatively, bricks may be produced by units designed for clay brick molding. Here, molding is achieved by extruding wet clay and subsequently cutting the wet

clay to size with a wire or knife. Some specialty brick are made in mold trays by pressing wet clay into mold pockets, allowing them to dry, and then subsequently firing the bricks. These processes are batch by weight or volumetric continuous or batch, generally due to the fact that the clay used to form regular prior art bricks is not consistent in its specific gravity, consistency, or chemical make up. Thus, a mass-based batch process would require that each clay or soil used be tested extensively to determine the proper amounts of necessary additives to properly balance the mix.

[0004] Many brick-making processes that are capable of producing cement-based bricks utilize vertical molding pressure. Some such processes also incorporate vibration of the mold to facilitate formation of the brick. Certain of these processes utilize indexing rotary tables with multiple molds to receive or perform a different process step at each index. Examples of the above-referenced machines are described in *Benjey*, U.S. Patent No. 3,127,657; *Prince*, U.S. Patent No. 3,904,723; *Toncelli*, U.S. Patent No. 4,698,010; *Whissell*, U.S. Patent No. 4,802,836, and others.

[0005] These machines may have twelve or more brick pockets measuring 16" by 3 5/8" by 2 1/4" arranged vertically and resting on a steel plate. Mix is dropped into the mold pockets. A mating mold top with mating pocket protrusions or rams is fitted automatically and the entire mold is vibrated and pressured from the mold top only. Such pressure may be described as downward pressure in the "y" axis, or "-y" pressure. The -y pressure continues until the top of the mix is compressed to approximately 7 5/8" from the steel plate. The mold sides are then lifted, sliding upward along the top mold protrusions, and lifted clean of the brick standing on end on the steel plate. The steel plate holding the brick is

then moved to a rack for subsequent steam curing. Most such processes also utilize indexing rotary tables with multiple molds to receive or perform a different process step at each index.

[0006] Horizontally pressured brick molding processes are described in the art, but are not commonly in use. In *Hereford*, U.S. Patent No. 5,145,692, a machine with two rotating tables having three mold boxes utilizing one compression cylinder and one ram press plate is described. Another machine, described in *Davis*, U.S. Patent No. 4,836,762, utilizes a horizontal turntable to handle primary and removable lined secondary molds that may be horizontally compressed and exchanged for new empty secondary molds as required. A mobile machine described in *Gross*, U.S. Patent No. 4,569,649, utilizes one horizontal cylinder to actuate two connected rams that operate on opposite sides of the machine. The machine has a pair of block forming molds at each end of the machine so that one brick is being formed while the other mold cavity is charging. The *Gross* machine also incorporates cylinder-actuated lift ram press faces in order to facilitate ejection of the brick by the compression ram.

[0007] Accordingly, the prior art processes and machines, regardless of whether they employ vertical or horizontal pressing, have at least two and generally three or more active axes, both rotary and linear. The complexity of these devices constitutes a drawback, the results of which are fully evident.

[0008] Moreover, all of the prior art cement-based or other processes utilize machines that require the steam curing of brick and paver product subsequent to molding. This curing is required because a mix already hydrated to a level sufficient for self-curing would stick to and clog the machines of the prior art. This additional step not only adds to the

complexity of the process and machine required, but it also adds to the completion time required for production.

[0009] Since at least as early as 1996, the brick making industry has been actively seeking better and more efficient forming techniques, in particular seeking to solve the problem of using a relatively wet mix such that no steam curing is required after formation of the brick. Eliminating steam curing means energy savings, time savings, less equipment investment and maintenance, and extensive overall improvements in productivity. Perhaps even more important, such a process could greatly facilitate building and rebuilding efforts in impoverished areas of the world, due to these advantages.

[00010] Numerous approaches to modifying the prior art to this end were tried, and failed, primarily due to the fact that a mix wet enough to overcome the need for steam curing will stick to and clog the machines of the prior art.

SUMMARY OF THE INVENTION

[00011] The present invention provides a process for making face bricks and brick pavers that overcomes the disadvantages of the prior art and provides the desired qualities of a brick-making process in producing brick in a continuous manner. The process of the present invention avoids the delay associated with the discrete batch processing of the prior art. Moreover, the continuous production afforded by the present mold process invention has the advantage of permitting unlimited production runs enabled by concurrently weighed and fed components. In addition, the process of the present invention permits change of color additives without halting the process.

[0010] The process of the present invention is highly efficient. Measuring and shaping prior to the compression function are performed in a charging chamber that is fed from a feed chute. Charge volume is determined by the controlled distance between front and

rear ram faces, when in position under the feed chute. The shutoff function is performed by the solid top of the rear ram at the bottom of the feed chute. Additionally, the present process invention is designed so that numerous machines utilizing the process may be operated in parallel to enhance efficiency. Accordingly, if production of one machine must be stopped for any reason, production of the other machines can proceed independently with a minimum adverse affect on brick production.

[0011] The process of the present invention facilitates production of bricks having homogeneous density throughout. This is accomplished by compressing the brick material along one axis in the mold chamber, in both the positive and negative directions of the axis. Moreover, it is the exposed brick or paver wear faces that receive the compression force. This results in making the faces more dense, while maintaining sufficient load bearing capacity in the perpendicular axis of the brick or paver.

[0012] The process of the present invention overcomes the disadvantage of the prior art whereby a mix hydrated to a level sufficient for self-curing would stick to and clog the machines of the prior art. This is accomplished by additional, mass flow continuous mixing of raw materials in the charge chamber (after delivery of the mix from a main auger-type mixer) and by the self-cleaning action of the ram design in the apparatus used to carry out the process.

[0013] The present invention requires a simpler mechanical device than those of the prior art. All phases of the molding are performed in one axis with two independently controlled rams. A second axis, though not part of the actual molding mechanism, is the indexing plate on a perpendicular axis, which accepts delivery of the ejected brick. The rams

act in concert to perform multiple functions: loading, compressing, transporting, and delivering the brick or paver.

[0014] These and other advantages are accomplished by the present invention of a process for making brick and brick paver. The process begins with sand feed bins on load cells with computer controlled variable speed screw conveyors delivering a ratioed mass weight of sand per unit time to the mixer. The weight of sand per unit time delivered is dependent upon the desired brick production rate. At the same time, Portland cement bins on load cells with computer controlled variable speed screw conveyors deliver a ratioed mass weight of cement per unit time to the mixer, the amount again depending on the desired brick production rate. Process water is delivered to the mixer in the same ratioed manner by a computer controlled variable speed pump. This is permissible in a mass flow process because water is constant at 1 gram equals 1 milliliter; the densities of the sand, cement, and pigment vary by manufacturer and moisture content. Inorganic pigments are fed to the mixer by computer controlled variable speed weight feeders in the same manner as the sand and the cement.

[0015] The above components form a crumb mix upon meeting in a cut flight screw, auger type mixer that also acts as a conveyor to a transfer screw conveyor. The crumb or wet cement mix has a moisture content of from approximately 8.5% to 10.5% of sample weight, or 15% to 20% of sample volume. A less wet mix requires steam curing to hydrate the brick after formation. The mixer is a computer controlled variable speed device. A variable speed transfer conveyor, also computer controlled, moves and continues to mix the crumb as it moves from the mixer to the mold feed chute. A reciprocating paddle mounted at the discharge end of the mold feed chute distributes the crumb evenly in the chute discharge

chamber. The production rate, set by an operator in terms of bricks per minute, controls the ratioed feed rates of each component to the mixer.

[0016] The machine used in connection with the process of the present invention provides a pair of reciprocal ram heads, each driven by a separate dual-action hydraulic cylinder having an internal piston, and a charge chamber fed by a feed chute. The front and rear rams move in concert along the flat bottom of the charge chamber. The movement of the rams causes the measurement of the correct amount of charge and its positioning into the mold chamber. At the same time, the solid flat upper surface of the rear ram seals off the additional charge in the feed chute. The front ram stops its motion at the right side of the mold chamber and reverses while the rear ram continues its advance into the mold chamber until the ram faces are an appropriate distance apart. This motion compresses the charge into an appropriately sized brick or paver. The front ram then retracts from the mold chamber, across the indexing plate to its home position. The rear ram pushes the brick onto the indexing plate and immediately retracts into the mold chamber and pauses while the indexing plate indexes and is ready to receive another brick. The rear ram continues retracting to its starting position. Additional crumb charge falls into the charge chamber as the rear ram retracts and the cycle begins again.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] **Fig. 1** is a top plan view of the machine used in connection with the process of the present invention;

[0018] **Fig. 2** is a side elevational view of the machine used in connection with the process of the present invention;

[0019] **Fig. 3** is a top plan view of the machine used in connection with the process of the present invention showing the front and rear rams moving the crumb charge into the mold chamber;

[0020] **Fig. 4** is a side elevational view of the machine used in connection with the process of the present invention at the same stage of production as shown in Fig. 3;

[0021] **Fig. 5** is a top plan view of the machine used in connection with the process of the present invention at the compression position;

[0022] **Fig. 6** is a side elevational view of the machine used in connection with the process of the present invention at the compression position;

[0023] **Fig. 7** is a top plan view of the machine used in connection with the process of the present invention after it has deposited a freshly made brick onto the indexing plate; and

[0024] **Fig. 8** is a side elevational view of the machine used in connection with the process of the present invention at the same stage as shown in Fig. 7.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] Referring more particularly to the drawings and initially to Figs. 1 and 2, there is shown the machine used in connection with the process of the present invention. The machine or mold unit includes a frame 100, onto which is mounted a rear ram 20 for longitudinal movement. A dual-action hydraulic rear cylinder 10 having an internal piston or other means for movement is provided. The rear cylinder 10 and the piston are attached to the rear ram 20 and the support frame 100 to move the rear ram longitudinally with respect to the support frame 100.

[0026] The process begins with sand feed bins on load cells (not shown) with computer controlled variable speed screw conveyors delivering a ratioed mass weight of sand

per unit time to the mixer (not shown). The weight of sand per unit time delivered is dependent upon the desired brick production rate. At the same time, Portland cement bins on load cells (not shown) with computer controlled variable speed screw conveyors deliver a ratioed mass weight of cement per unit time to the mixer, the amount again depending on the desired brick production rate. Process water is delivered to the mixer in the same ratioed manner by a computer controlled variable speed pump (not shown). This is permissible in a mass flow process because water is constant at 1 gram equals 1 milliliter; the densities of the sand, cement, and pigment vary by manufacturer and moisture content. Inorganic pigments are fed to the mixer by computer controlled variable speed weight feeders (not shown) in the same manner as the sand and the cement. With respect to the sand feed bins, cement bins, and inorganic pigment feeders, two of each type may be used, such that one bin or feeder is refilling from bulk storage while the other is online.

[0027] Still referring to Figs. 1 and 2, mounted on the frame 100 is a feed chute 30 into which clay or cementious and other material may be placed. In the process of the present invention, the feed chute 30 receives sand from sand feed bins (not shown), Portland cement form cement bins (not shown), process water delivered by a computer controlled variable speed pump (not shown), and inorganic pigments delivered from computer controlled variable speed weight feeders (not shown). Two bins of each type may be used, such that one bin is refilling from bulk storage while the other is online. The portion of the frame 100 directly below the feed chute 30 forms the bottom of charge chamber 40. The mold face of the rear ram 20 is positioned at the left side of the charge chamber 40, and in fact forms the left side thereof when positioned appropriately. On the frame 100 opposite the rear ram 20 are the front ram 50 and dual-action hydraulic front cylinder 80 having an internal

piston, mounted for longitudinal movement. The front cylinder 80 and the piston are attached to the front ram 50 in the support frame 100 to move the front ram 50 longitudinally with respect to the support frame 100.

[0028] As may best be seen in Fig. 1, the indexing plate 70 is positioned perpendicularly, between the front 50 and rear 20 ram faces, to one or multiple parallel mold units spaced appropriately so that the indexing plate 70 receives 1 brick from each mold unit on each cycle, and then indexes and receives the next cycle of bricks. If the parallel mold units are spaced 30 inches apart on center, a 10 inch index between cycles results in 2 inch spacing between the paver and 2 3/8 inch spacing between brick ends. Three cycles fill one indexing plate 70. The plate 70 is then fed into a receiving rack (not shown) and a new empty plate 70 is positioned to receive the next cycle of bricks.

[0029] It will be appreciated that the indexing plate 70 seen in Fig. 1 moves in a gap between the front 50 and rear 20 ram faces and is supported by a device such as rollers located at each gap. The plate index 70 may be driven by any number of means, including an intermittently energized electromagnet attached to a hydraulic cylinder located parallel to and above the plate 70 magazine. In this case, when an index is required, the cylinder begins from the retracted position with the electromagnet attached to the rod end and working pole face resting on the top surface of the plate 70 being fed. The electromagnet is energized to grip the plate 70 and the cylinder extends a distance, preferably 10 inches. The electromagnet is then de-energized and the cylinder retracts to its original position, ready for the next index.

[0030] The process of the present invention does not require apparatuses to provide steam curing and subsequent firing after production of brick or brick paver. The mass flow continuous mixing of the process of the present invention facilitates use of a crumb

charge, or cement mix, with a moisture content sufficient for self-curing following molding. A moisture content in the mix of from approximately 15% to 20% of sample volume is required to permit self-curing after molding.

[0031] The preferred formula for the various components is (a) 1431 grams of sand; (b) 477 grams Portland cement; (c) 158 to 200 grams water; and (d) 10 to 40 grams inorganic, insoluble oxide pigment(s). The sand used must be free of organic material (generally called "washed" sand), and may range in size from micros to 4 mm, as long as there are sufficient smaller sand particles to bridge the gaps between larger particles. Typically, sand is derived from river dredging or sand pits. A common product referred to as "play box sand" is sufficient. The type of Portland cement used is not important to the process but does affect product cure times, ultimate strength, and color. The water used must be fresh, not salt, water and may come from government water systems, streams, rivers, or lakes. The total mass of a preferred process run is 2076 grams.

[0032] Testing indicates that bricks and brick pavers produced by the process of the present invention exceed relevant strength and absorption requirements. Moreover, the process of the present invention is significantly more economical without the additional machinery required by the prior art, and the fact that the process of the present invention is founded on mass flow rather than batch by weight, volumetric continuous, or batch preparations means that the process is a continuous feed to a cyclic mold unit, and thus more productive than prior art processes. Thus, investment costs, operating costs, and cleaning effort and costs are all greatly reduced by the process of the present invention.

[0033] The product of the process of the present invention meets or exceeds the ASTM and building code requirements for fired clay face brick. By comparison, products

of prior art processes, including blocks of ice and compacted earth, could never survive the ASTM testing regimen of compressive strength, 24-hour cold water absorption, 5 hour boil absorption, saturation coefficient, and initial rate of absorption, never mind building codes and specifications.

[0034] The significance of the process to the brick industry may be appreciated by considering that the conventional brick industry is bound by the production technique of blending clays, shale, and water to make a malleable mix that is profile extruded and wire cut into bricks, which are then steam cured, dried, and fired in very large tunnel ovens. The Portland cement based portion of the brick industry is miniscule in comparison to the clay based segment of the industry—probably less than ½ of 1% of the market on any comparative basis. The process of the present invention has succeeded in creating a machine that produces a Portland cement based product that is competitive with the clay based product in every respect—price, physical characteristics, and aesthetics. Key to the viability of the process was avoiding firing or steam autoclaving (curing) to make the process economically feasible; this was accomplished by virtue of the mass flow continuous mixing feature of the process, as it facilitates use of a mix wet enough to self-cure but which would stick to the machinery under normal process conditions.

[0035] **Example 1**: Cement, water, and a fine aggregate were mixed and molded according to the process of the present invention:

TABLE 1

Sample Number	Dimensions L x W (in)	Load Area (in^2)	Total Load (lbs.)	Compressive Strength (psi)	Absorption %
5/30-3	3.6 x 3.5	12.60	62,500	4,960	8.3

The sample of Example 1 exceeds requirements of the American Society for Testing and Materials (ASTM C 55-99, standard specifications of concrete brick) (namely, 3000 psi and 12.4%, discussed below).

[0036] **Example 2**: Cement, water, and a fine aggregate were mixed and molded according to the process of the present invention:

TABLE 2

Sample Number	Dimensions L x W (in)	Load Area (in^2)	Total Load (lbs.)	Compressive Strength (psi)	Absorption %
5/30-1	3.55 x 3.6	12.78	55,000	**4,304**	**9.0**

The sample of Example 2 exceeds requirements of the American Society for Testing and Materials (ASTM C 55-99, standard specifications of concrete brick).

[0037] **Example 3**. Cement, water, and a fine aggregate were mixed and molded according to the process of the present invention:

TABLE 3

Sample Number	Dimensions L x W (in)	Load Area (in^2)	Total Load (lbs.)	Compressive Strength (psi)	Absorption %
5/29-3	3.5 x 3.55	12.43	45,300	**3,646**	**9.1**

[0038] The sample of Example 3 exceeds requirements of the American Society for Testing and Materials (ASTM C 55-99, standard specifications of concrete brick).

[0039] **Example 4**: Cement, water, and a fine aggregate were mixed and molded according to the process of the present invention:

TABLE 4

Sample Number	Dimensions L x W (in)	Load Area (in^2)	Total Load (lbs.)	Compressive Strength (psi)	Absorption %
5/29-2	3.6 x 3.6	12.96	46,000	3,549	9.4

The sample of Example 4 exceeds requirements of the American Society for Testing and Materials (ASTM C 55-99, standard specifications of concrete brick).

[0040] The average data of the above examples indicates compressive strength of 4,115 pounds per square inch (psi), and absorption of 8.95%. The ambient density of the examples averages 125.95 pounds per cubic foot (lb/cu. ft.). Given a moisture regain of approximately one to two percent, the samples fall into the medium weight classification under ASTM specification C 55-99 (125 lb/cu. ft. maximum) on an oven dry basis. This density requires a maximum absorption limit of 12.4% (13 lb/cu. ft. ÷ 105 lb/cu. ft.). The compression requirement is 3,000 psi individual and 3,500 psi average of three. See ASTM Specification C 55-99, Table 2. Accordingly, as all the above examples demonstrate, the process of the present invention produces, without subsequent steam curing, cementious brick products that more than exceed standard fired clay brick requirements.

[0041] Moreover, the drying shrinkage of these examples is essentially zero (0.0004%). This far exceeds the moisture content requirement for type I grade N brick units (from 0.03 to 0.065% total linear drying shrinkage). See ASTM Specification C 55-99, Table 1. Units produced by the machine of the present invention have been measured at 0.917% moisture content at 44% relative humidity, 84° Fahrenheit, and a dew point of 57° Fahrenheit.

[0042] Referring again to Fig. 1 and Fig. 2, the forming portion of the process of the present invention begins with the feed chute 30 receiving sand from sand feed bins (not shown), Portland cement from cement bins (not shown), process water delivered by a

computer controlled variable speed pump (not shown), and inorganic pigments delivered from computer controlled variable speed weight feeders (not shown). The feed chute 30 accepts the intermediate product crumb from a device such as a screw conveyor bin that is fed from a mixer (not shown). A reciprocating plate attached to and driven by the mixer cooperates with a mold transfer screw located at the mixer's discharge opening to distribute the crumb uniformly in the charge chamber 40. With the charge chamber 40 filled and the feed chute 30 partially filled, the molding cycle of the present invention proceeds.

[0043] As is best seen in Fig. 2, the mold face of the rear ram 20 is positioned at the left side of the charge chamber 40. The mold face of the front ram 50 is positioned at the right side of the charge chamber 40. In a preferred embodiment of the process of the present invention, the dimensions of the charge chamber 40 used for the production of face brick are preferably 7 inches between the mold face of the front ram 50 and the mold face of the rear ram 20, and 7 5/8 inches between the sides of charge chamber 40. The bottom of charge chamber 40 is flat. As illustrated in Fig. 2, the bottom of charge chamber 40 is formed by a portion of the frame 100. The dimensions of the mold faces of rear ram 20 and front ram 50 are preferably 7 5/8 inches by 2 1/4 inches, but may vary as desired. In a preferred embodiment of the present invention, therefore, the volume of the mold chamber 60 and the amount of crumb that proceeds to the next step is 120 cubic inches.

[0044] Referring now to Fig. 3 and Fig. 4, the rear ram 20 has a solid, flat top surface. The front ram 50 and rear ram 20 advance in concert, thus taking the 120 cubic inch crumb charge into the mold chamber 60 as the solid flat top surface of the rear ram 20 seals off the crumb in the feed chute 30.

[0045] Turning now to Fig. 5 and Fig. 6, the front ram 50 stops its motion at the right side of the mold chamber 60 and reverses while the rear ram 20 continues its advance into the mold chamber 60 until the face of rear ram 20 and the face of front ram 50 are preferably 3 5/8 inches apart. The mold chamber 60 dimensions are preferably 7 1/2 inches long by 2 1/4 inches high by 7 5/8 inches wide. In a preferred embodiment of the present invention, the crumb is thus compressed into a 62.2 cubic inch brick measuring 7 5/8 inches by 3 5/8 inches by 2 1/4 inches.

[0046] Referring to Fig. 7 and Fig. 8, the front ram 50 then retracts from the mold chamber 60, across the indexing plate 70 to its home position. The rear ram 20 then pushes the brick 90 onto the indexing plate 70 and immediately retracts into the mold chamber 60 and pauses while the indexing plate 70 indexes and is ready to receive another brick 90.

[0047] Referring once again to Fig. 1 and Fig. 2, the front ram 50 now extends across the indexing plate 70, enters the mold chamber 60, and follows the retraction of rear ram 20 until it reaches its position at the right side of the mold chamber 60. The rear ram 20 continues retracting to its starting position. In a preferred embodiment of the present invention, the face of the rear ram 20 is 7 inches away from the face of front ram 50. The crumb falls into the charge chamber 40 as the rear ram 20 retracts and the cycle begins again.

[0048] The molding process of the present invention may be powered any number of ways. In a preferred embodiment of the present invention, however, hydraulically powered computer-controlled servo valves enable cycle times of approximately 10 seconds. The adjustable cycle time of the mold units determines the speeds of every device in this continuous process. When utilized as hereinabove described, the process of the present

invention facilitates a turnaround time of just over eight hours between mixing, molding, racking, and final palletizing, inasmuch as the machine of the present invention can utilize a mix moist enough to permit ambient self-curing of about eight hours, and no apparatus, energy, or time for steam-curing or similar assisted curing after molding is required. It should be noted, however, that the operator of the apparatus sets the production rate in terms of bricks per minute, and that this production rate determines the ratioed feed rates of each component to the mixer.

[0049] This abbreviated turn-around time is also facilitated by the continuous flow of crumb to the charge chamber 40. As is seen in Fig. 2, the charging chamber itself serves as a measuring and shaping device prior to the compression function when the front 50 and rear 20 rams are in the charging position. No batch-to-mix weighings are performed in the production sequence. Color may be added on a continuous basis, even changing colors, without stopping and cleaning the machine. A few transitional bricks will be produced, but the machine is self-cleaning and may proceed apace.

[0050] The ramifications of this production turn-around time of approximately eight hours are that unsold brick inventory can be completely eliminated, as it will be appreciated that the general construction industry's order-to-consumption time is a minimum of two months. Moreover, the ability to change color "on the fly" during the continuous production process enhances the ability to respond immediately to changes in demand.

[0051] The actual molding step in the mold chamber 60 seen in Fig. 6 compresses the brick 90 along the horizontal axis in both the plus "x" and minus "x" directions simultaneously. Thus, instead of vibrating <u>and</u> pressuring one axis, as is common in the prior art, the mold unit of the present invention simply provides uniform compression

across the faces of the brick 90. This makes the density of brick 90 homogeneous throughout its cross-section. Further, the brick 90 possesses greatly enhanced compressive strength, as noted above in test Examples 1 through 4.

[0052] To create a paver, as opposed to face brick, the process of the present invention operates in the same ways described above, except the face of the rear ram 20 and front ram 50 preferably are changed to 4 inches by 8 inches and the compression mold chamber 60 profile preferably is 4 inches high by 8 inches wide. The rams 20 and 50 transport and compress the mix as previously described and produce a 4 inch by 8 inch by 2 inch paver by pressurizing the + x and - x horizontal axis.

[0053] The process of the present invention may be employed in multiples, four in a row, for example, so that one cycle produces four bricks 90. The bricks 90 are ejected onto an indexing plate 70 that, as filled, proceeds to a standard indexing rack (not shown) which when filled contains 480 bricks 90. The rack may be trolley mounted and may join a row of racks previously filled. The bricks 90 then await 8 hours minimum self-curing in ambient conditions. The full rack may then be transferred to another trolley track to proceed to palletizing. It will be appreciated that the brick 90 may be tumbled prior to palletizing to produce irregular edges and corners.

[0054] As shown in Fig. 1, the indexing plate 70 used in connection with the process of the present invention is preferably 5 inches wide, 120 inches long, 3/8 inch thick and capable of holding 12 bricks or pavers when full. The indexing plate 70 is positioned perpendicularly, between the spaces of rear ram 20 and front ram 50, to multiple parallel mold units of the present invention, which may preferably be spaced 30 inches apart on center so that the indexing plate 70 receives one brick from each mold unit on each cycle. The

indexing plate 70 then indexes and receives the next cycle of bricks 90. A ten inch index between cycles results in two inch spacing between the ends of brick 90 pavers and a 2 3/8 inch spacing between brick 90 ends. Three cycles fill one indexing plate 70. The plate 70 is then set into a receiving rack and a new empty plate 70 is positioned to receive the next cycle of bricks 90.

[0055] The above description and the accompanying drawings show that the present invention provides a novel molding process that not only overcomes the deficiencies and shortcomings of the prior art, but also provides novel features and advantages not found in previous processes. The process of the invention produces bricks continuously in a self-cleaning fashion and without any steam-curing machinery or vibrating parts. Unlimited production runs are enabled by concurrently weighed and fed components. Colors can be changed on the fly, without stopping production and cleaning the apparatus used in connection with the process.

[0056] The continuous molding process of the invention is simpler in design than the prior art and less expensive in light of the reduced mechanical assembly costs and maintenance costs. The apparatus used in connection with the process is durable in construction and has a long useful life. Commercially available materials and components can be utilized in the fabrication of the molding apparatus using conventional metal working techniques and procedures.

[0057] The process of the invention can be utilized to mold a variety of different products. Variations in composition, structure, and surface appearance of the product can be achieved simply and quickly with the process of the invention.

[0058] It will be apparent that various modifications can be made in the particular continuous molding process as described in detail above and shown in the drawings within the scope of the present invention. The size, configuration, and arrangement of components and materials can be changed to meet specific requirements. For example, the continuous molding process can be modified to produce square, rather than rectangular, bricks or pavers by merely altering the receiver plate index length. Altering the angular placement of the supporting frame used in connection with the process relative to the front and/or rear ram faces would permit production of triangular or other shaped bricks or pavers. These and other changes can be made in the continuous molding process provided the functioning and operation thereof are not adversely affected. Therefore, the scope of the present invention is to be limited only by the following claims.